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ASELLUS (*ASELLUS*) *ALASKENSIS*, N. SP.,
THE FIRST ALASKAN *ASELLUS*, WITH REMARKS
ON ITS ASIAN AFFINITIES
(CRUSTACEA: ISOPODA: *ASELLIDAE*)

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North American freshwater isopods of the family Asellidae are widespread east of the Great Plains in the United States and southern Canada (to about 46°N). West of the Great Plains asellids apparently do not occur naturally until they reappear in the Pacific Coast states and the province of British Columbia (Williams, 1970; Bowman, 1974). *Asellus communis* Say, a species that is distributed mainly in the northeastern United States and southern Canada, occurs in Boulder and Larimer counties, Colorado, but was probably introduced there by man (Williams, 1970). Winger, Peters, Donahoo, Barnes, and White (1972) reported *Asellus tomalensis* Harford from the Provo River, Utah. Dr. Winger kindly sent some of the Utah specimens, and they proved to be *A. racovitzai racovitzai* Williams, a form with a distribution similar to that of *A. communis*. It appears likely that the Provo River populations were also introduced.

Assuming artificial transference of the Colorado and Utah asellids, a wide geographic gap separates the eastern and west coast populations of *Asellus*. It has been suggested that the western species, *A. occidentalis* Williams and *A. tomalensis* Harford, are more closely related to Asian than to eastern North American asellids (Henry and Magniez, 1970), but this seems unlikely (Bowman, 1974).

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The northernmost record for a west coast *Asellus* is Double Bay, Hansen Island, Queen Charlotte Strait (50°35'N, 126°46'W) [Williams (1970) erroneously located Double Bay on Vancouver Island; the correct location is given in Bousfield's (1963) station list (Bousfield, in litt.)]. The 4 samples reported below of a new species from Alaska, from which asellids were previously unknown, extend the record slightly north of the Arctic Circle. The new species is noteworthy not only because it is the first known Alaskan asellid, but also because it belongs to *Asellus* (*Asellus*), restricted by Henry and Magniez (1970) to include only 5 Eurasian species and 8 troglobitic species from Japan. The Alaskan asellid thus has affinities with Eurasian rather than with North American species of *Asellus*, most of which have been assigned to *Conasellus* Stammer (1932) by Henry and Magniez. The resulting zoogeographical implications are discussed below.

***Asellus* (*Asellus*) *alaskensis* new species**

Figures 1-10, 12-24, 27-32

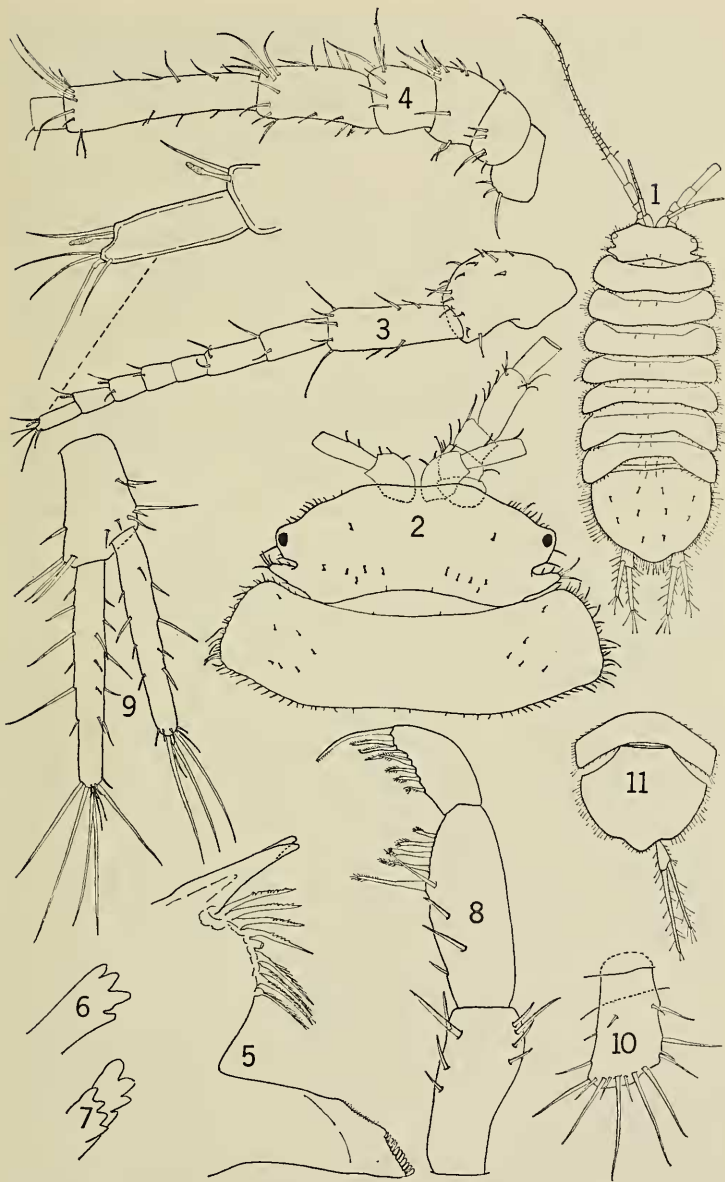
[?] *Asellus* sp.—Watson, Davis, and Hanson, 1966, p. 576 [in list].

Material examined: All from the Noatak and Selawik lowlands, Alaska. Niglaktak Lake (66°35.5'N, 159°56'W), 22 August 1968, 1 ♂, 2 ♀; 19 September 1970, 59 ♂ ♀; collected by Charlotte Holmquist. Inland Lake (66°28'N, 159°50'W), 22 August 1968, 1 ♀, collected by Charlotte Holmquist. (For details of the 2 lakes see Holmquist, 1975). "Lake No. 1," Noatak River Drainage Basin, 14.5 km east of Kiligmak Inlet, collected by Donald G. Huggins: 15 August 1973, 43 ♂ ♀; 18 August 1973, open water on *Lemna*, 40 ♂ ♀

Types: Holotype, 7 mm ♂, from "Lake No. 1," August 1973, USNM 151224. The remaining specimens listed above are paratypes. The paratypes from Niglaktak Lake have been deposited in the Naturhistoriska Riksmuseet, Stockholm; those from "Lake No. 1" have been deposited in the National Museum of Natural History, Smithsonian Institution, Washington, except for 10 specimens from the 18 August collection which were returned to Dr. Huggins.

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FIGS. 1-10. *Asellus alaskensis*: 1, ♀, dorsal; 2, ♀ head and pereonite 1, dorsal; 3, ♀ antenna 1, dorsal; 4, ♀ antenna 2, ventral; 5, ♂ right mandible; 6, Incisor of ♂ right mandible; 7, Incisor and lacinia of ♂



left mandible; 8, ♂ mandibular palp; 9, ♀ right uropod, dorsal; 10, Protopod of ♀ left uropod, ventral. FIG. 11, *Asellus latifrons*, ♂ urosome (copied from Birstein, 1951).

Diagnosis: With the characters of the subgenus *Asellus* as defined by Henry and Magniez (1970) and closely resembling *A. latifrons* Birstein (1947), but distinguished by the absence of a rostrum, the shorter and blunter postmandibular lobes, the less prominent caudomedial lobe of the telson, the relatively shorter uropodal rami, and the narrower ♀ pleopod 2.

Description: Length of largest ♂ (excluding antennae and uropods) 7.4 mm. Other ♂♂ with differentiated pleopods 1 and 2, 5.3–6.2 mm. ♀♀ with small oostegites, 6.2 mm. Body gradually increasing in width to pereonite 7; greatest width about $\frac{3}{5}$ length. Head about twice as wide as long; anterior margin shallowly concave; postmandibular lobes separated by deep fissure, latter broader and more rounded medially than in *A. latifrons*; head more rounded anterior to fissure and postmandibular lobes shorter and more obtuse than in *A. latifrons*.

Pereonites broadly expanded laterally; insertions of pereopods set well in from lateral margins of pereonites; coxae much reduced, not visible in dorsal view. Pereonite 7 overlapping anterolateral parts of pleotelson.

Telson about $\frac{1}{2}$ wider than long; caudomedial lobe relatively broader and less sharply delimited than in *A. latifrons*. Margins of telson densely setose.

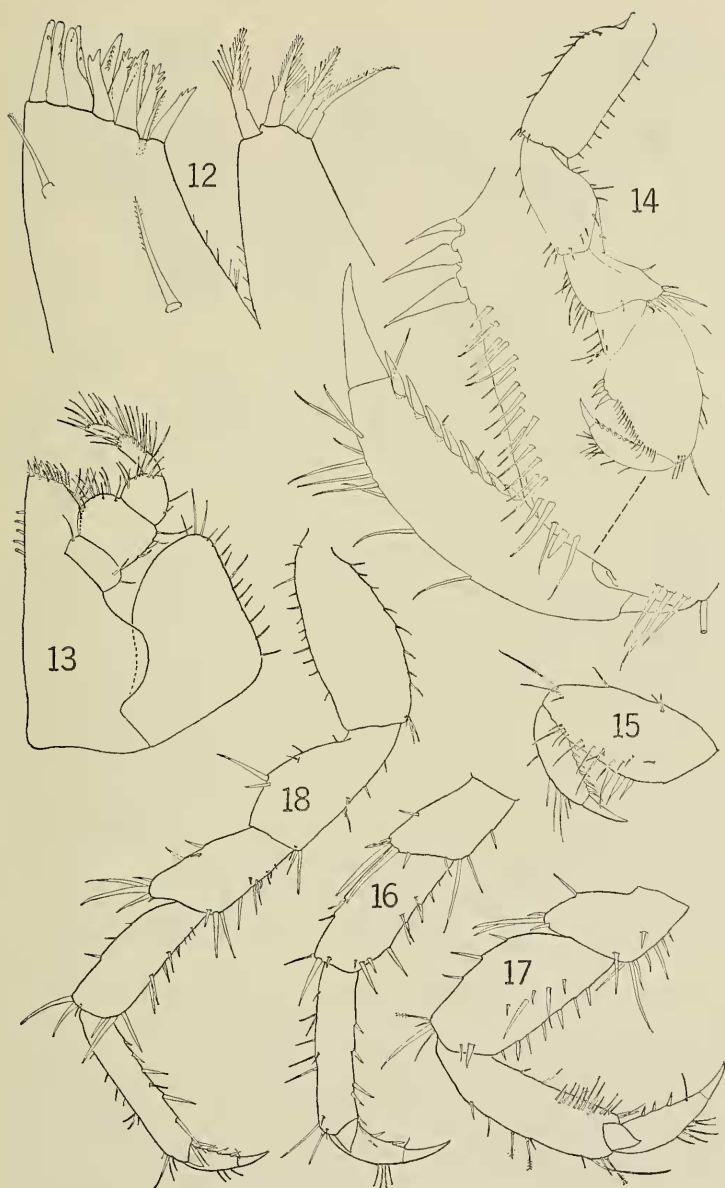
Antenna 1 reaching distal third of last segment of antenna 2 peduncle; flagellum of 6–7 segments, last 3 segments each bearing esthete. Antenna 2 about 0.6 length of body; last segment of peduncle about 1.5 times as long as preceding segment; flagellum of 25–35 segments.

Mandible with 4-cuspidate incisors and lacinia mobilis; spine row of right mandible with 9 dentate and plumose spines, of left mandible with 7 plumose spines; palp as in Fig. 8. Maxilla 1, apex of outer lobe with 11 dentate spines and 1 plumose seta, body of outer lobe with 2 additional plumose setae; inner lobe with 4 apical plumose setae. Maxilla 2, outer lobe with 12 and 10 setae on outer and inner lamina respectively; inner lobe with oblique row of 23 setae. Maxilliped with 4–5 retinaculæ.

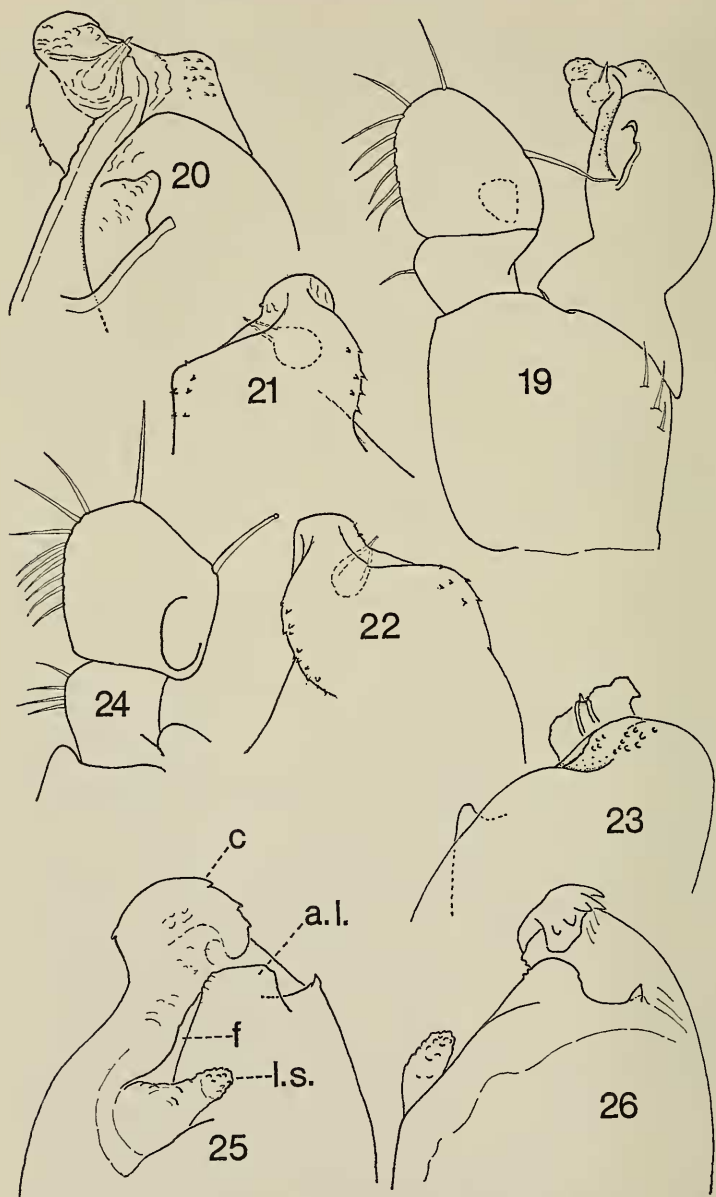
Pereopod 1, propus nearly twice as long as wide, palm defined by 3 spines borne on small boss in ♂, but flush with palm in ♀; dactyl with 7–8 spines on posterior margin. Dactyls of pereopods 3–7 with 2–5 spines, fewer on more posterior dactyls. Pereopod 4 more robust in ♂ than in ♀; merus and carpus broader and more spinose in ♂; propus of ♂ with cluster of slender spines distally.

Male pleopod 1 quadrate, slightly longer than pleopod 2; protopod half as long as exopod, with 3–4 retinaculæ; exopod subrectangular, nearly twice as long as broad, lateral and distal margins armed with long plumose setae, those on distal margin longer, shorter naked setae inserted submarginally.

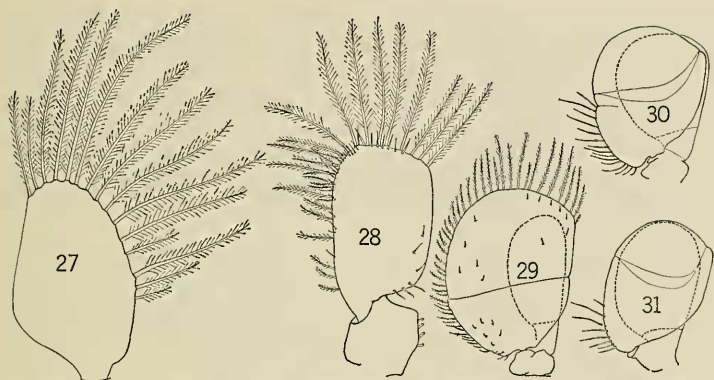
Male pleopod 2 protopod about as long as wide, with 3–5 distomedial setae. Exopod $\frac{3}{4}$ as long as protopod; proximal segment with 1–4 setae on lateral margin; distal segment oval, with 8–10 lateral setae and 1–2 larger medial setae, proximomedial part of posterior surface with well developed catch lobe. Endopod (see discussion below for terms used)



FIGS. 12-18. *Asellus alaskensis*: 12, ♂ maxilla 1; 13, ♂ maxilliped; 14, ♂ right pereopod 1; 15, ♀ left pereopod 1; 16, ♀ pereopod 4; 17, ♂ pereopod 4; 18, ♀ left pereopod 7.



FIGS. 19-24. *Asellus alaskensis*: 19, ♂ pleopod 2; anterior; 20, Tip of endopod of ♂ pleopod 2, anterior; 21-22, Same, posterior; 23, Same, lateral; 24, Exopod of ♂ pleopod 2, posterior. FIGS. 25-26, *Asellus aquaticus*, tip of endopod of ♂ pleopod 2: 25, Anterior; 26, Lateral. Abbreviations: c, capitulum; a.l., anterior lobe; f, fissure; l.s., labial spur.



FIGS. 27-31. *Asellus alaskensis*, anterior views of pleopods: 27, ♀ pleopod 2; 28, ♂ pleopod 1; 29, ♂ pleopod 3; 30, ♂ pleopod 4; 31, ♂ pleopod 5.

slightly longer than exopod, about twice as long as wide (width not including spur); curving gently laterally. Fissure bounded proximally by transverse sclerotized bar; medial lip of fissure with U-shaped labial spur connecting proximally with transverse bar. Anterior lobe low, broadly rounded, without medial spine present in *A. aquaticus*. Capitulum with central cannula, produced posteriorly into ledge and caudally into spinose lobe.

Female pleopod 2 oval, about $1\frac{1}{3}$ times as long as wide, with about 15 plumose setae on distal and lateral margins. Pleopod 3 exopod about $1\frac{1}{4}$ times as long as wide, proximal segment about $\frac{2}{3}$ length of distal segment. Exopods of pleopods 4 and 5 with about 15 and 8 setae respectively on proximolateral margins; exopod of pleopod 4 with a partial suture; both pleopods with double false suture distally in form of crescent.

Uropods about $\frac{3}{4}$ as long as pleotelson, not so slender and relatively shorter than in *A. latifrons*; armature of long and short setae as in Figure 9.

Etymology: The specific name, *alaskensis*, refers to the occurrence of the new species in the state of Alaska.

Relationships: The presence of 4 setae on the inner lobe of maxilla 1, the boss proximal to the palm on the male pereopod 1, and the rounded female pleopod 2, taken together, place the Alaskan species in *Asellus* (*Asellus*) as restricted by Henry and Magniez (1970). Within the subgenus, *A. alaskensis* and the west Siberian *A. latifrons* are set apart from the other species by having lateral head incisions and reduced coxae not visible in dorsal view. The male pleopod 2 endopod tip of *A. latifrons* is not illustrated in sufficient detail to permit a comparison of this taxonomically important structure in the 2 species, but it seems evident

from the overall similarity that *A. alaskensis* and *A. latifrons* are descendents of a common ancestor and have no close relatives among other species of *Asellus* (*Asellus*). They, as well as *A. epimeralis* Birstein from Lake Bount, exhibit certain characters that Birstein considered primitive because they are found in juveniles but not in adults of *A. aquaticus*: the large size of the rami in proportion to the protopod of the male pleopod 2; the elongate female pleopod 2; and the straight lateral margins of the exopod of the male pleopod 1, lacking the excavation of the adult *A. aquaticus*.

The wide taxonomic gap between *Asellus alaskensis* and other North American Asellidae has been referred to already. Other examples of Alaskan freshwater invertebrates with Eurasian rather than North American affinities can be cited, for example among the Turbellaria (Kenk, 1953) and the diaptomid Copepoda (Wilson, 1953).

Terminology for endopod of ♂ pleopod 2: American zoologists, beginning with Steeves (1963) and followed by Williams (1970, 1972) and Fleming (1972, 1973) have applied standard terms to the 4 or fewer elements forming the tip of the ♂ pleopod 2 endopod. The number and form of these elements have been given great weight in recent works on North American asellids and have formed the basis for proposed phylogenies, either wholly (Steeves, 1966) or in part (Williams, 1970). We have not attempted herein to apply Steeves' terms to *A. alaskensis* because homologies cannot be assumed between the Alaskan asellid and the species of *Conasellus*. In fact, the assumed homologies of the endopodal elements among species of *Conasellus* cannot be taken to have been proven beyond doubt.

Perhaps because this component species can be distinguished readily by other characters, consistent terms have not been applied to the structures of the endopod of the ♂ 2nd pleopod in *Asellus* (*Asellus*) species. We found it necessary, therefore, to devise the terms used in the above description of *A. alaskensis*. Our terms are listed below, together with those used by Maercks (1930) and Needham (1938) for the same structures in *A. aquaticus*.

This paper	Maercks	Needham
basal spur	processus calcariformis or "Sporn"	spur
fissure	Spalt	opening of seminal cavity
labial spur	processus cylindriformis + Håkchen	conical spur, or head of hammer
anterior lobe	-----	mobile lappet
capitulum	Spiralhaken	recurved distal tooth of lateral edge

Zoogeography and ecology: Birstein (1951) interpreted the known present distribution of *Asellus* (*Asellus*) spp. in Siberia (Fig. 32) as

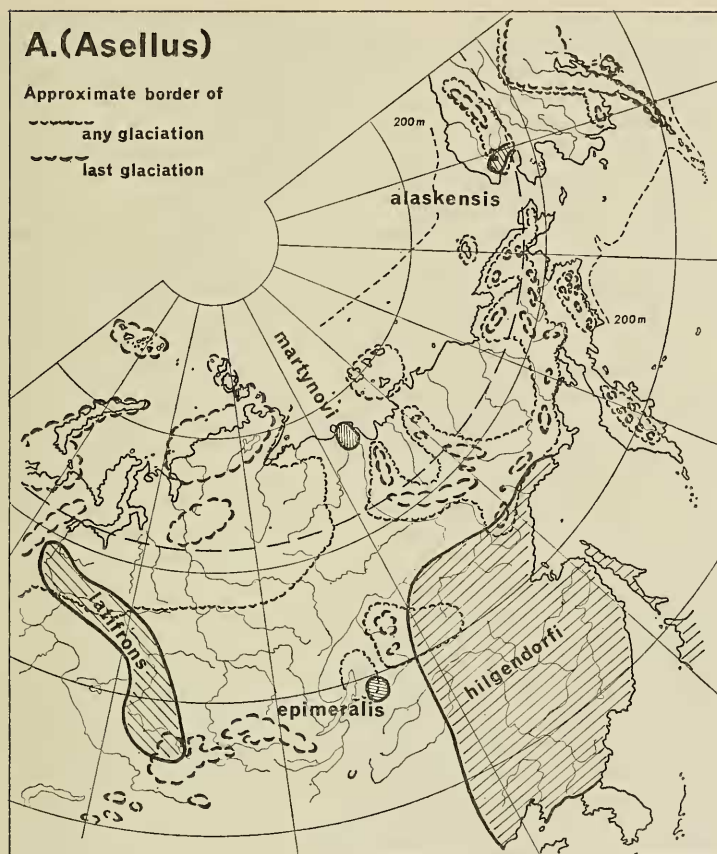


FIG. 32. Known distribution of epigeal species of the subgenus *Asellus* in Asia and Alaska. Asian data based on Birstein (1951).

remnants of a vast continuous distribution in preglacial times. He believed that severe conditions associated with Pleistocene glaciation wiped out all but a few populations, namely *A. latifrons* in the Ob-Irtysh basin, *A. epimeralis* in Lake Bount, and *A. hilgendorfi martynovi* in the Lena delta.

With the discovery of *A. alaskensis*, Birstein's hypothesis would require the preglacial distribution to stretch nearly the entire distance across northern Siberia and across the Bering Strait into an area of Alaska on the north side of Kotzebue Sound. The Bering Strait presents no obstacle to this distribution, since the Bering Land Bridge was present during the early Tertiary until the late Miocene and again during most

of the Pleistocene (Hopkins, 1967). In preglacial times *A. latifrons* and *A. alaskensis* may have still been a single species, with the now remaining marginal populations beginning to diverge or having already differentiated as extremes of a variable species or as subspecies. Birstein would then have the Siberian glaciers of the Pleistocene exterminate the entire *latifrons-alaskensis* populations between the existing "relicts," i.e., over the vast extent of about 6100 km (3800 miles).

Birstein's hypothesis may prove to be correct—only time will tell—but it suffers from 2 major deficiencies. 1. It requires more intolerable conditions resulting from glaciation in northern Siberia than can be supported by the available evidence; 2. It assumes that the freshwater fauna of northern Siberia is well known, and that further collecting will not change the overall distribution patterns of Siberian *A. (Asellus)* spp.

As in other areas the exact extent of glaciation in Siberia is still somewhat obscure, but because there was less precipitation the ice sheets were less extensive and thinner than those in Europe and North America (Fig. 32; Charlesworth, 1957; Woldstedt, 1954–1965). Areas uncovered by snow and therefore dark would have absorbed much radiant heat during summers, and the many bodies of water acted as heat reservoirs during winters. Even so, conditions during glacial periods probably would have been severe enough to have eliminated some asellid populations, but other asellid populations might have survived. It is known that Alaskan lakes deeper than about 2 m generally do not freeze to the bottom (Brewer, 1958; Holmquist, 1973), and there must be many such lakes in Siberia. These lakes also have a layer of unfrozen ground beneath them; the thickness of this layer is correlated with the depth of the lake and the volume of unfrozen water in it. If only a little oxygen is present asellids should be able to survive in this layer of unfrozen water. *A. aquaticus* can survive up to 48 h without oxygen at a temperature of 16–20°C and normally requires only 0.4–0.5 mg/l (Levanidov, 1949). Even if a lake should freeze to the bottom it is possible that asellids might survive. Some invertebrates, including certain insect larvae and crustaceans, can withstand being frozen in ice (Scholander, Flagg, Hock and Irving, 1953), and although there is no evidence that asellids could survive such treatment, the possibility cannot be ruled out.

Although Birstein (1951) gave the impression that the distribution of asellids in northern Siberia is well known, there appear to be a number of unexplored areas where asellids might be expected to occur. A most useful summary of limnological investigations in the U.S.S.R. was given by Zhadin and Cerd (1963), and from this work one can get some idea of the extent of the areas not investigated for *Asellus*.

Moving eastward from the Ob basin, inhabited by *Asellus latifrons*, we find that nothing is said about the Pur and Taz Rivers. The authors listed 1 isopod in the Yenisei fauna, which must be *A. (Baicalasellus) angarensis* Dybowsky, which inhabits the upper reaches of the tributary Angara River as well as Lake Baikal. On the Taimyr Peninsula, Lake Taimyr has been studied and no asellids found, but the Pyasina and

Taimyr Rivers have not been investigated. No information is given about the bottom fauna of the Khatanga, Anabar, and Olenek Rivers. *Asellus hilgendorfi martynovi* Birstein (not mentioned by Zhadin and Gerd) inhabits lakes in the delta of the Lena River (Birstein, 1951). Zhadin and Gerd listed *A. aquaticus* from the middle reaches of the Lena, but this must be a misidentification, since *A. aquaticus* does not occur in Siberia. The bottom fauna of the Yana, Indigirka, and Kolyma Rivers have not been studied, nor has that of the Anadyr.

In addition to the foregoing major river systems, there are numerous uninvestigated shallow lakes in Siberia, and these may offer more favorable habitats for asellids than the deeper lakes and rivers that have received more attention from hydrobiologists.

The reason why *Asellus alaskensis* was taken only in 2 lakes of the western part of the Holmquist survey area is obscure. This survey was undertaken during 6 summers of the period 1961–1970. About 100 lakes were investigated over a large area, from about 129°33' to 165°41'W, and from about 65°07' to 71°23'N (Holmquist, 1975). Huggins's collection (see above) comes from an area not very far from the 2 lakes mentioned, and the report by Watson, Davis and Hanson (1966) of an *Asellus* in the Cape Thompson area concerns the same north-western part of Alaska.

Other invertebrates showing such a western occurrence are the oligochaetes *Alexandrovina onegensis* and *Styloscolex opisthothecus* (Holmquist, 1974a, 1974b). *A. onegensis* was taken in approximately the same area as *Asellus*, but it is known otherwise only from its type locality, Lake Onega in Europe. *S. opisthothecus*, a species originally described from localities on Kamchatka, was found in the survey area in 2 lakes slightly further north than *Asellus*. It belongs to a genus otherwise known from Japan, Manchukuo and Lake Baikal. These facts are apt to strengthen the significance of the Bering Land Bridge as a means of dispersal for freshwater invertebrates. They also emphasize the lack of knowledge of the freshwater fauna of vast northern areas.

Niglaktak Lake is fairly weedy. It is rather shallow (maximum depth noted, about 1.8 m) with the vascular plants consisting mainly of *Potamogeton* and *Myriophyllum*. On the first visit to this lake a great quantity of the blue-green alga *Gloeotrichia* was obtained in the net. The invertebrate fauna of the lake also seemed luxuriant. Among others, the above-mentioned oligochaete *Alexandrovina* was taken here. Inland Lake appeared equally shallow (maximum depth noted about 1.9 m) but less weedy. Only small fragments of *Potamogeton* were secured. The plankton seemed rich and varied, and the benthic fauna was varied.

Lakes of the Noatak valley are generally about as shallow. Such lakes may be presumed to warm up fairly quickly in this area, once the ice is gone from the surface. However, there is no protection from the frequent winds, which are apt to effectively stir up the water of these rather large lakes and thus moderate the heating rate. In the fall the winds are cool and presumably cause the whole body of water to cool

down close to freezing temperature before the surface is iced over, protecting the deeper parts from freezing. Thus, during the long winter a temperature between 1° and 4°C, but closer to the lower limit, is presumed for the benthic environment. At the end of the summer (22 August 1967) a temperature of about 14°C was measured in both lakes. Summer temperatures may be higher than those recorded during this survey. On September 19, 1970, water in Niglaktak Lake measured only 4°C. These facts may give some idea of the conditions under which *A. alaskensis* is living.

In summary, *Asellus alaskensis* and *A. latifrons* are descendants of a common ancestor that once ranged across the entire breadth of northern Siberia and into Alaska. The slight morphological differences between the 2 species may already have existed before Pleistocene glaciation or may have developed only after the Ob-Irtysh and Alaskan populations were isolated by extermination of intervening populations during Pleistocene glaciations. It is possible that at least some of the intervening populations were not wiped out during the Pleistocene but still exist in unstudied lakes and rivers, and even if further investigations should demonstrate the absence of intervening populations, this would not prove that they were eliminated during the Pleistocene. Isolation and speciation might have occurred much earlier.

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